(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 469 594 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91112914.6**

(51) Int. Cl.5: **G03D 13/00**

(22) Date of filing: **31.07.91**

(30) Priority: **03.08.90 JP 206198/90**
12.07.91 JP 198485/91

(43) Date of publication of application:
05.02.92 Bulletin 92/06

(84) Designated Contracting States:
DE FR GB

(71) Applicant: **FUJI PHOTO FILM CO., LTD.**
210 Nakanuma Minami Ashigara-shi
Kanagawa(JP)

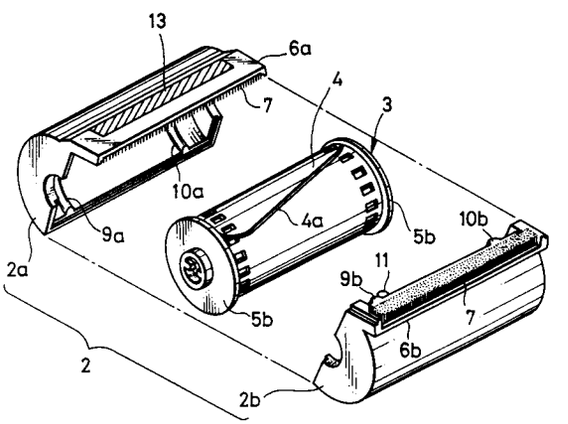
(72) Inventor: **Takahashi, Kouichi**
c/o FUJI PHOTO FILM CO., LTD., No. 210, Nakanuma
Minami-Ashigara-shi, Kanagawa(JP)
Inventor: **Kawada, Ken, c/o FUJI PHOTO FILM CO., LTD.**
798, Miyanodai, Kaisei-machi
Ashigarakami-gun, Kanagawa(JP)
Inventor: **Shiota, Kazuo, c/o FUJI PHOTO FILM CO., LTD.**
798, Miyanodai, Kaisei-machi
Ashigarakami-gun, Kanagawa(JP)

(74) Representative: **Patentanwälte Grünecker, Kinkeldey, Stockmair & Partner**
Maximilianstrasse 58
W-8000 München 22(DE)

(54) A photographic film handling method.

(57) In a photographic film cassette, rotation of a spool in a direction of unwinding a photographic film causes a film leader to advance to an outside of a cassette shell. An exposed film is drawn out of the cassette shell after advancing the film leader for developing the exposed film in a state with a film trailer attached to the spool so as to keep the cassette shell reusable. The exposed film is wound up into the cassette shell after development. The spool is rotated in the unwinding direction in a printer in order to advance the film leader outward. The exposed film is drawn out of the cassette shell frame by frame after advancing the film leader for subjecting the developed film to printing in a state with the film trailer attached to the spool. The spool is rotated in a direction of winding up the developed film after printing for containing the exposed film in the cassette shell.

FIG. 1



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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of handling photographic film and a film cassette for containing the same, more particularly to a photographic film handling method in which a cassette shell for containing unexposed film is reused.

2. Description Relative to the Prior Art

135-type photographic films have been widely used in recent years, as compact cameras and single-use cameras are widespread to enlarge the consumption of photographic films contained in film cassettes. The photofinishing process consists of a film developing process, a printing process and a paper developing process in the case of negative film. There have been provided simplified types of photofinishing systems such as mini-laboratory equipments capable of continuously effecting the series of processes for the purpose of simplicity and rapidity in operation. There is also proposed for convenience in operation a film cassette in which rotation of a spool in a direction of unwinding a photographic film causes a film leader to advance to an outside of a cassette shell, as described in U.S.P. 4,832,275, 4,834,306, and 4,846,418, Japanese Patent Laid-open Publication No. 2-124564, and a plurality of Japanese patent applications filed by the present applicant.

When a laboratory receives an order from a customer for processing a photographic film after exposure, an exposed film is drawn out of a cassette shell, developed, cut into film pieces of a predetermined length, e.g. of six image frames, inserted in a film sheath, and given back to the customer together with photoprints printed from the developed film. However, it is inconvenient to handle film pieces that are cut to a predetermined length, because the film pieces require rather a large space. This procedure also is inefficient because a posterior process is necessary to insert the film pieces in the film sheath besides a process for cutting an exposed film in a laboratory into shorter film pieces. Reprinting of extra printing of a developed film cannot be performed efficiently, because separated film pieces are spliced together in elongation therefor.

Conventionally, a photofinisher unwinds and separates an exposed film from the cassette shell for developing and printing, and throws the emptied cassette shells away. A great number of emptied cassette shells have been thrown away as industrial waste, which is undesirable in view of economy of resources and protection of environment.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a photographic film handling method by which efficiency in photofinishing processes is enlarged.

It is another object of the present invention to provide a photographic film handling method in which industrial waste is reduced by reusing a cassette shell after developing photographic film without throwing it away.

In order to achieve the above and other objects and advantages of this invention, a photographic film cassette is handled in which cassette rotation of a spool in a direction of unwinding a photographic film causes a film leader to advance to an outside of a cassette shell. The spool is rotated in the unwinding direction in order to advance the film leader out of the cassette shell. The exposed film is drawn out of the cassette shell after advancing the film leader for developing the exposed film in a state with the film trailer attached to the spool so as to keep the cassette shell reusable. Efficiency in photofinishing processes is enlarged by the method according to the present invention.

According to a preferred embodiment, the exposed film is wound up into the cassette shell after development. The spool is rotated in the unwinding direction in a printer in order to advance the film leader out of the cassette shell. The exposed film is drawn out of the cassette shell frame by frame after advancing the film leader for subjecting the exposed film to printing in a state with the film trailer attached to the spool. The spool is rotated in a direction of winding up the exposed film after printing for containing the exposed film in the cassette shell. Industrial waste is reduced by reusing a cassette shell after developing photographic film without throwing it away. Not only a photofinisher but also a customer can easily handle a developed film for arrangement and preservation by reuse of a cassette shell.

According to another preferred embodiment, the spool is rotated in a direction of winding up the exposed film after development for containing the exposed film in the cassette shell. The spool is rotated in the unwinding direction in a slide-mounting machine in order to advance the film leader out of the cassette shell. The exposed film is drawn out of the cassette shell frame by frame for cutting the exposed film into respective film pieces of image frames created on the exposed film so as to mount the film pieces on slide mounts.

According to a further preferred embodiment, the spool is rotated in the unwinding direction for advancing the film leader of the photographic film out of the cassette shell after exposure. The photographic film is drawn out until drawing a first end of

a connecting sheet out of the cassette shell, the connecting sheet beforehand being wound on the spool together with the photographic film in a state with the first end connected to the film trailer and with an opposite second end fixed on the spool in order to connect the photographic film to the spool. The photographic film is separated from the connecting sheet for development. The photographic film is connected after development to the first end of the connecting sheet drawn out of the cassette shell. The spool is rotated in the winding-up direction for containing the developed film in the cassette shell together with the connecting sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and advantages of the present invention will become more apparent from the following detailed description when read in connection with the accompanying drawings, in which:

Fig. 1 is an exploded perspective view illustrating a photographic film cassette to be handled in the present invention;

Fig. 2 is a section view illustrating the film cassette illustrated in Fig. 1;

Fig. 3 is an explanatory view illustrating a photofinishing system for processing the film cassette illustrated in Fig. 1;

Fig. 4 illustrates the photofinishing system illustrated in Fig. 3 in combination of a film processor and a printer-processor;

Fig. 5 is a schematic view illustrating a slide-mounting processing machine for processing the film cassette illustrated in Fig. 1;

Fig. 6 is perspective view illustrating a film pull stage in a film processor for use according to another preferred embodiment, and a film cassette positioned therein;

Fig. 7 is a schematic view illustrating a film feeding section of the film processor illustrated in Fig. 6;

Fig. 8 is a schematic view illustrating a film wind-up section of the film processor illustrated in Fig. 6;

Fig. 9 is a plane view illustrating the film wind-up section illustrated in Fig. 8;

Fig. 10 is a flowchart schematically illustrating a photographic film handling method by use of the film processor illustrated in Fig. 6;

Fig. 11 is a schematic view illustrating a film wind-up section for use according to a further preferred embodiment; and

Fig. 12 is a perspective view illustrating a shape in which a film trailer of the photographic film is cut according to yet another preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE PRESENT INVENTION

In Figs. 1 and 2 illustrating a photographic film cassette to be handled in the present invention, the film cassette consists of a cassette shell 2 including upper and lower shell halves 2a and 2b of plastics, a spool 3 rotatably supported therebetween, and a photographic film 4 wound in a roll between flanges 5a and 5b of the spool 3 in a state with a film trailer arrested on the spool 3.

Upper and lower tongues 6a and 6b are formed on the shell halves 2a and 2b each integrally. A light trapping fabric or plush 7 well-known in the art is attached to the inside of the tongues 6a and 6b, and traps light coming into a film passageway 8 defined between the tongues 6a and 6b. Ridges 9a 9b, 10a and 10b are formed on the inside surfaces of both shell halves 2a and 2b, and are in contact with the outermost turn of the photographic film 4 wound in a roll so as to prevent the photographic film 4 from loosening. A separating claw 11 is formed in the innermost position of the lower tongue 6b near the ridge 9b, and is in contact with the outermost turn of the photographic film 4 slightly interior to film perforation regarding the widthwise direction of the photographic film 4 for separating a leading end portion 4a of a film leader from the roll of film 4. The outside surface of the upper tongue 6a is provided with a magnetic recording portion 13, which data are magnetically to be written in and read out of. In the present film cassette, the photographic film 4 is completely wound in the cassette shell 2 up to the leading end portion 4a. However, clockwise rotation of the spool 3 can cause the leading end portion 4a to advance through the film passageway 8. Because prevented from loosening by the ridges 9a, 9b, 10a and 10b, the photographic film 4 in a roll is rotated clockwise when rotating the spool 3 clockwise. Further rotation of spool 3 in a state with the leading end portion 4a located in the innermost position of the film passageway 8 causes the separating claw 11 to separate the leading end portion 4a to guide it to the film passageway 8, so that the leading end portion 4a is advanced to the outside of the cassette shell 2.

When this film cassette is loaded in a camera with the leading end portion 4a wound up in the cassette shell 2, the leading end portion 4a is advanced by rotating the spool 3 with a film feeding mechanism of the camera. Thus the loading of the film cassette is simplified without need of protruding the film leader to the outside of the cassette shell of a conventional film cassette. After taking photographs in the camera, the exposed film 4 is wound up in the cassette shell 2 until the leading end portion 4a by use of a rewinding mechanism in the camera. The film cassette is

then unloaded from the camera. The film cassette containing the exposed film 4 is forwarded to a photolaboratory through the agency of a photofinishing agent.

Such a film cassette thus forwarded to a photofinisher is treated by following procedures schematically illustrated in Fig. 3, in which a film cassette 15 contains the exposed film initially before development in light-tight fashion. The film cassette 15 is subjected to a film developing process, in which a spool rotating device 16 constituted of a motor 16a and a fork 16b rotates the spool 3 in the unwinding direction so as to advance the leading end portion 4a. When advanced to a predetermined degree, the leading end portion 4a is caught by a catcher 17, whereas the spool rotating device 16 is removed from the spool 3.

When catching the leading end portion 4a by the catcher 17, the catcher 17 is relatively moved apart from the cassette shell 2, out of which the exposed film 4 is drawn completely. The film trailer of the exposed film 4 is kept in attachment to the spool 3. The exposed film 4 is moved in the film developing machine together with the cassette shell 2. The exposed film 4 passes through well-known processing tanks such as a developing tank, a fixing tank, a rinsing tank, and is dryed.

Referring to Figs. 4 and 4A illustrating schematically the film processor, the film cassette 15 after exposure is conveyed in a darkroom by a conveyer belt 19, and positioned in a drawing-out station 21 by a transporter 20. The cassette shell 2 is supported in a cassette holder 22 in the drawing-out station 21, where the spool rotating device 16 is coupled with the spool 3. In the drawing-out station 21, the catcher 17 stands by just below the tongues 6a and 6b of the cassette shell 2. The spool rotating device 16 is operated to advance the leading end portion 4a to the outside of the cassette shell 2. The spool rotating device 16 is removed from the spool 3 when the catcher 17 catches the leading end portion 4a.

After the leading end portion 4a is caught by the catcher 17, the cassette holder 22 and the catcher 17 start movement at the same time with a passageway 24 followed by the cassette holder 22 and a passageway 25 followed by the catcher 17. When the cassette holder 22 is raised during a horizontal movement of the catcher 17, the exposed film 4 is drawn out of the cassette shell 2 because nothing arrests rotation of the spool 4. The distance between the cassette holder 22 and the catcher 17 is kept to be constant. The exposed film 4 passes in cooperation of the cassette shell 2 through processing tanks 26 such as a color developing tank, a bleaching/fixing tank, a rinsing tank, and a stabilizing tank to perform development of photographic film 4.

The exposed film 4 developed in the processing tanks 26 is dryed with heated air blown by a dryer 27, and positioned in a wind-up station 28, where the leading end portion 4a is released from the arrest of the catcher 17. A spool rotating device similar to the spool rotating device 16 is coupled with the spool 3, and rotates it in the direction of winding up the developed film 4. The developed film 4 is rewound in the cassette shell 2. A transporter 29 removes the film cassette 15 from the cassette holder 22, and transports it to a conveyer belt 30 for discharge.

The film cassette 15 is subjected to a printing process after the developing process. The spool 3 is rotated in the unwinding direction by a spool rotating device 32 in the printing process in the same manner as the beginning of the developing process in order to advance the leading end portion 4a to the outside of the cassette shell 2. The leading end portion 4a as advanced is taken up and fed by a sprocket 43 later to be described in detail (see Fig. 4B), and wound about a reel 33. The reel 33 is driven by a motor 34 to feed the developed film 4 frame by frame. Each image frames on the developed film 4 is successively printed on to photographic paper or color paper 35.

The color paper 35 after printing is developed in a paper processor section 36 of a printer-processor having a color developing tank, a bleaching/fixing tank, and a rinsing tank, and cut frame by frame to be photoprints 37. Upon completion of printing all the image frames recorded on the developed film 4, a motor of the spool rotating device 32 is reverse rotated to rewind the developed film 4 from the reel 33 into the cassette shell 2 at the end of the printing process. The film cassette 15 containing the developed film 4 is returned to its customer together with the photoprints 37.

Referring to Fig. 4B illustrating a printer-processor for performing the above printing process and the paper developing process, the film cassette 15 conveyed by the conveyer belt 30 after the developing process is transported by a transporter 40 and positioned in a cassette holder 41. The cassette holder 41 is provided with the spool rotating device 32 which causes the leading end portion 4a to advance.

The sprocket 43 is provided on the cassette holder 41. The leading end portion 4a advanced from the cassette shell 2 is fed toward the reel 33 under a film mask 44 by the sprocket 43 and arrested on the reel 33. The motor 34 is driven to wind the developed film 4 frame by frame on the reel 33 each time that a light source unit 42 causes the respective image frames to be printed on the color paper 35. The color paper 35 after each exposure is transported when the developed film 4

is fed frame by frame. The exposed paper 35 is successively passed through processing tanks 45 constituted of a color developing tank, a bleaching/fixing tank and the like, dryed in a drying drum 46, cut by a cutter 47 frame by frame to be the photoprints 37.

The light source unit 42 illuminates image frames on the developed film 4 with printing light, of which the intensity and the color are regulated in accordance with images frames. The density and tone of the image frame positioned in the printing position are measured by a color scanner, from which measured data are supplied to a microcomputer 48. The microcomputer 48 supplies the light source unit 42 with control data corresponding to the data supplied from the color scanner, and regulates the printing light of the light source unit 42.

The control data supplied to the light source unit 42 are written in a magnetic recording portion 13 on the cassette shell 2 by means of a magnetic head 49 capable of recording/reading data. If the customer owning the film cassette 15 places an order for reprinting, data are read out of the magnetic recording portion 13 for regulating the light source unit 42 according thereto, so that it is possible to reprint the image frames in a condition the same as the initial photoprints.

It is noted that an IC memory instead of the magnetic recording portion 13 may be mounted on the cassette shell 2 for storing control data. A data recording area may be alternatively formed on the photographic film 4 for writing control data on the photographic film 4. Such a data recording area can be a magnetic material layer formed on a predetermined portion of the photographic film 4. It is also noted that the magnetic recording portion, an IC memory or a data recording area may store ID data for identifying the photographic film, photograph taking data regarding conditions in recording image frames on the photographic film.

When all the image frames on the developed film 4 are printed, the motor of the spool rotating device 32 is reverse rotated to wind the developed film 4 again in the cassette shell 2. The film cassette 15 is transported to a passage 50 by the transporter 40 and sent to a conveyer belt 51.

By use of a system for processing film cassettes, the photographic film 4 is handled in constant combination with the cassette shell 2 after taking photographs in a camera until returning the developed film 4 with photoprints. It is possible to use the cassette shell 2 as a container for returning the developed film 4 without need of cutting the developed film 4 into film pieces generally constituted of every six pieces. The cassette shell 2 is in a perfect correspondence with the photographic film 4, so that it is possible by recording ID number and exposure conditions at the printing time therein to classify the orders for printing and reprinting and to improve efficiency in reprinting operation. There is no need to throw away the cassette shell 2 so that no pollution of industrial waste is caused even with plastics molded into the cassette shell.

Referring to the cassette shell 2 containing reversal film as the photographic film 4, the reversal film is subjected to a slide-mounting process after a reversal film developing process. In Fig. 5 illustrating a system for the slide-mounting process, the reversal film 4 after development is wound up in the cassette shell 2, which is conveyed by a conveyer belt 53 as a film cassette 52 in a manner similar to negative film.

The film cassette 52 at a predetermined position is transported by a transporter 54 to a cassette holder 55, which is provided with the spool rotating device 32 (see Fig. 3) and the sprocket 43 in a manner the same as the cassette holder 41 of the printer-processor. The leading end portion 4a is initially advanced to the outside by the spool rotating device 32. The reversal film 4 is drawn out then by the sprocket 43 frame by frame, and cut by a cutter to be respectively separate film pieces 57 of one frame, which are raised by a transporter 58 having a suction cup and placed on a slide mount 60 supplied on a conveyer belt 59. The slide mount 60 is one of those successively supplied to the conveyer belt 59. The slide mount 60 with the film piece 57 placed thereon is conveyed to a mounter 63 constituted of a guide member 61 and a pressing roller 62. The slide mount 60 is conveyed to the mounter 63 in an open state, folded in two by the guide member 61, pressed by the pressing roller 62 so as to integrate the film piece 57 with the slide mount 60 inside, and dropped on a passage 64 to be stored in a receiving case 65. When the film piece of the final image frame has been subjected to the slide-mounting process, the transporter 54 takes up the emptied cassette shell 2 from the cassette holder 55 and drops it into a receiving box 66. The cassette shell 2 made from plastics is thrown away as industrial waste, but can be reused by melting it again to be pellets.

The system as described above is such that either the printing process or the slide-mounting process is effected in a manner continuous with the process of developing the exposed film 4. However, the present invention is applicable to a system such that the film cassette after a developing process is subjected either to a printing process or a slide-mounting process in a machine installed in a manner completely separate from a film processor. It is possible for such a system to use a printer or a slide-mounting machine of types different from the herein-described embodiment in order to meet any specified purposes.

Another preferred embodiment is now de-

scribed in which exposed photographic film is separated from a cassette shell, developed, and contained in an original cassette shell as a developed film preserving cassette with reference to Fig. 6. A photographic film cassette 70 is constituted of a cassette shell 71, a spool 72 rotatably supported in the cassette shell 71, and photographic film 73 wound about the spool 72 with the film trailer fixed thereon.

The cassette shell 71 is formed in the shape of a prism in joint of shell halves 71a and 71b molded from synthetic resin, and provided with a film passage mouth 74 for passing the photographic film 73 and openings 75 for supporting the spool 72 and for exposing a coupling end 72a to an outside. A plush or light trapping fabric 76 is attached to the film passage mouth 74. A film containing chamber 77 defined inside the cassette shell 71 has an internal diameter substantially equal to the maximum diameter of the photographic film 73 as wound about the spool 72. When the spool 72 is rotated in the film unwinding direction by inserting a fork 78 in the coupling end 72a, a leading end of the photographic film 73 is guided by the inside surface of the film containing chamber 77 and advanced to the outside of the film passage mouth 74. It is noted that the film cassette 71 is shaped to be a box-like prism for enlarging stability at the time when a plurality of film cassettes are lapped one over another, but may be cylindrical such as a conventional film cassette.

A film leader 73a is in the shape with one lateral side cut off as well-known in the art for reducing the resistance to feeding the photographic film 73 when advancing the film leader 73a and feeding the photographic film 73 toward a take-up spool in a camera. The lateral side of the film leader 73a opposite to the side cut off is provided with perforations 73b to be engaged with a film threading member of the camera for feeding the film leader 73a to the take-up spool after being let out of the cassette shell 71. A film main portion 73c of the photographic film 73 is provided with positioning perforations 73d one for each of the image frames 73e for being detected mechanically or optically in order to position each of the image frames 73e on an aperture of the camera.

On the photographic film 73 fully drawn out of the cassette shell 71, a layer of hot-melt adhesive area 79 is formed between a final image frame 73f and the spool 72 on a back surface opposite to the photosensitive emulsion surface of the photographic film 73. When the whole of the exposed film 73 is drawn out of the cassette shell 71 for development, the exposed film 73 is cut along a line between the final image frame 73f and the hot-melt adhesive area 79 so as to keep the hot-melt adhesive area 79 attached to the cassette shell 71. Such a cutting line 80 is virtually indicated by the two-dot-dash line in Fig. 6. The portion of the film trailer left on the cassette shell 71 is used as a connecting sheet for connecting the exposed film 73 after development to the spool 72. It is noted that the hot-melt adhesive area 79 may be formed on the photosensitive emulsion surface or on both surface of the photographic film 73. When both surfaces are provided with an adhesive area, efficiency in the developing process is improved because either adhesive area may be used for connecting the developed film 73.

In Fig. 7 illustrating a film processor for developing the photographic film 73 exposed by loading the film cassette 70, a cassette holder 82 is formed in the shape of a rectangular elongated box, in which a plurality of film cassettes are contained with their film passage mouth 74 directed in the same direction. The lower portion of the cassette holder 82 is provided with a cassette feeding mechanism 83 which includes lower and upper stopper pins 84 and 85 for retractibly projecting into the cassette holder 82. The stopper pins 84 and 85 are swingably supported on both ends of an arm 86 by means of connecting members 87, and project alternately into the cassette holder 82 through guide holes 88 in correspondence with a displacement of the arm 86. A coiled spring 89 biases the arm 86 so that the lower stopper pins 84 project into the cassette holder 82.

A solenoid 90 is connected to the arm 86 by means of a plunger 91, and displaces the arm 96 in excitation in order to alternate projection of the stopper pins 84 and 85. A single film cassette in the position between the lower and upper stopper pins 84 and 85 exclusively falls on a film pull stage 81. After a fall, the solenoid 90 is deenergized to return the arm 86 to the home position indicated by the solid line by means of the coiled spring 89. Instead of using the stopper pins linked by the arm 86 to position the film cassette 70 alone, the stopper pins may be driven separately by using two solenoids or the like.

As illustrated in Fig. 6, the film pull stage 81 is provided with the fork 78 slidable in the axial direction of the spool 72. A shifter 92 shifts the fork 78 in the axial direction to displace it from a retracted position to a position for engaging the fork 78 with a coupling end 72a of the spool 72. A motor 93 rotates at the time of taking the engaging position to rotate the spool 72 in the unwinding direction to advance the film leader 73a to an outside of the film cassette 70.

As illustrated in Fig. 7, a feeding passage 95 is formed from a film passage mouth 94 of the film pull stage 81, and provided with a leading end sensor 96, a sensor 97 for detecting the hot-melt adhesive area 79, a cutter 98, a pair of drawing

rollers 99 and a pair of feeding rollers 100 successively disposed. The leading end sensor 96 detects the film leader 73a fed in the feeding passage 95. The drawing rollers 99 then starts rotation to feed the exposed film 73 to the feeding rollers 100. The drawing rollers 99 and the feeding rollers 100 are controlled as to rotation to provisionally reserve a predetermined length of film in the shape of a loop between the drawing and feeding rollers 99 and 100 in order to stand by for being cut by the cutter 98. After forming such a loop, the exposed film 73 is fed in a processor section by the drawing and feeding rollers 99 and 100.

The cutter 98 cuts away the film leader 73a in a straight line to separate the film main portion 73c from the portion with one lateral side cut off, and cuts the film main portion 73c away from the cassette shell 71 after drawing the whole of the exposed film 73 out of the cassette shell 71. A guide plate 102 is provided to be coaxial with a lower drawing roller 100a of the drawing rollers 100 for swinging upward in order to guide the cut-off leading end portion toward a throwaway passage 103. The guide plate 102 recovers the downward initial position after throwing away the film leader, and guides a front end newly formed of the exposed film 73 toward the drawing rollers 100.

The sensor 97 optically detects the adhesive area 79 on the film trailer of the exposed film 73. The drawing rollers 99 stop rotation upon detection of the adhesive area 79. The cutter 98 is then actuated to cut the exposed film 73 along the virtual cutting line 80 in front of the hot-melt adhesive area 79 so as to separate the exposed film 73 from the cassette shell 71. The length of film reserved as a loop between the drawing rollers 99 and the feeding rollers 100 decreases during the film cutting process, so that the exposed film 73 is incessantly fed into the processor section 101. Although the film trailer is detected by detecting the adhesive area 79 in the present embodiment, it may be alternatively detected by detecting a displacement of the cassette shell or a tension of drawing the exposed film in the feeding direction when drawing out the whole film.

Referring to a cassette ejecting mechanism 105 illustrated in Fig. 6, the mechanism 105 is constituted of an ejecting bracket 106 and a shifter 107 for shifting the ejecting bracket 106 in the axial direction of the spool 72, and ejects an emptied cassette shell 70a separated from the exposed film 73 to shift it from the film pull stage 81 to a cassette conveyer 108, which consists of conveyer belts for conveying the emptied cassette shell 70a to a film wind-up section 109.

In Figs. 8 to 10, the film wind-up section 109 is disposed in the position downstream from the film processor 101, and winds up the developed film 73 into the emptied cassette shell 70a positioned in the film wind-up stage 111. As illustrated in Fig. 9, the cassette conveyer 108 conveys the emptied cassette shell 70a to the side of the film wind-up stage 111. The emptied cassette shell 70a conveyed to an end of the cassette conveyer 108 is shifted by a cassette shifting mechanism 110 toward the film wind-up stage 111.

Referring to Fig. 8, the outlet of the processor section 101 is provided with a film reservoir 112, which consists of two pairs of feeding rollers 113 and 114 and a swingable guide plate 115. The guide plate 115 takes a guiding state to guide the front end of the developed film 73 let out of the processor section 101 toward the feeding rollers 114 disposed in the downstream position of the film reservoir 112, and downward swings in retraction to form a spacing for a loop of film. The reservoir 112 reserves the developed film 73 in the shape of a loop between the feeding rollers 113 and 114 by stopping rotation of the feeding rollers 114 for the time of a following process such as splicing the developed film 73 in a splicing unit 116.

There are disposed a film end sensor 117, a rotary cutter 118, the splicing unit 116 and a cassette supporting unit 119 successively on the side downstream from the feeding rollers 114. The film end sensor 117 detects the front end and the film trailer of the developed film 73. The film end sensor 117 generates a front end detecting signal, according to which the feeding roller 114 positions the front end of the developed film 73 in the splicing position of the splicing unit 116, and generates a film trailer detecting signal, according to which the rotary cutter 118 cuts off the film trailer in a predetermined shape. A pair of rolled cutting edges 118a and 118b are provided on the peripheral surfaces of the rotary cutter 118, of which the diameter of each circumference will be determined to be suitable for cutting the film trailer, though the size is illustrated to be small in the drawings. The rotary cutter 118 thereby cuts the film trailer to have a smaller width in a manner of the film leader 73a before developing the exposed film 73 as illustrated in Fig. 6 in order to facilitate the advance of a new free end of the film toward the outside of the cassette shell and reduce its resistance to the plush 76.

The splicing unit 116 is provided with a thermal head 116a for melting the layer in the hot-melt adhesive area 79 on a connecting sheet 120 of the emptied cassette shell 70a so as to adhere the connecting sheet 120 in pressure to the front end of the developed film 73. The cassette supporting unit 119 consists of two supporting plates 119a and a solenoid 119b for shifting the supporting plates 119a up and down, and supports the emptied cas-

sette shell 70a in a fixed position during winding up the developed film 73 as well as releases the emptied cassette shell 70a from being supported after wind-up.

As illustrated in Fig. 9, a rotary shaft 122 rotates the spool 72 in the direction of winding up the developed film 73 to contain the developed film 73 in the emptied cassette shell 70a in a roll. The rotary shaft 122 is constituted of a motor 123 and a shifter 124 in a manner the same as the fork 78 for letting out the exposed film 73. The shifter 124 inserts the rotary shaft 122 in the coupling end 72a of the spool 72. The motor 123 rotates the spool 72 in the film wind-up direction so as to wind up the developed film 73 in the emptied cassette shell 70a. A cassette ejector 125 consists of an ejecting bracket 126 and a shifter 127 for ejecting the cassette shell with the developed film 73 wound up therein from the film wind-up stage 111 toward a receiving tray 128.

The operation of the present embodiment is now described with reference to a flowchart illustrated in Fig. 10. The film cassette 70 is first inserted in the cassette holder 82 as illustrated in Fig. 7. A plurality of film cassettes are lapped one over another in the cassette holder 82 in a state stopped by the lower stopper pins 84. The solenoid 90 of the cassette feeding mechanism 83 is actuated so that the single film cassette 70 between the stopper pins 84 and 85 is positioned in the film pull stage 81. The fork 78 is axially shifted by the shifter 92 as illustrated in Fig. 6. While the fork 78 is coupled with the coupling end 72a, the motor 93 is rotated to rotate the spool 72 in the unwinding direction to advance the film leader 73a. The exposed film 73 with the film leader 73a advanced is fed along the feeding passage 95 as illustrated in Fig. 7. The film leader 73a is cut by the cutter 98 to be a straight front end, from which a separated film leader is thrown away. The drawing and feeding rollers 99 and 100 are controlled as to rotation in order to reserve the exposed film 73 in the form of a loop at a length corresponding to time necessitated for cutting the film trailer by using the rotary cutter 118, and then in order to feed the exposed film 73 into the processor section 101.

When the whole length of the exposed film 73 is drawn out of the cassette shell 71 during development, the hot-melt adhesive area 79 is detected by the sensor 97, which generates a detecting signal to actuate the cutter 98, which cuts the exposed film 73 in front of the hot-melt adhesive area 79. After cutting the exposed film 73 away from the cassette shell 71, the cassette shell 71 or the emptied cassette shell 70a is ejected from the film pull stage 81 to the cassette conveyer 108 by the cassette ejecting mechanism 105. The emptied cassette shell 70a is fed to the film wind-up stage 111 in the film wind-up section 109 by the cassette conveyer 108 and the cassette shifting mechanism 110.

Upon letting the straight front end out of the processor section 101 after developing the whole of the exposed film as illustrated in Fig. 9, the front end is fed along the swingable guide plate 115 up to the splicing unit 116, and is positioned in the splicing position in accordance with a front end detecting signal generated from the film end detecting sensor 117. The front end is adhered to the connecting sheet 120 of the emptied cassette shell 70a in the splicing unit 116 by use of the hot-melt adhesive area 79.

The spliced developed film is wound up in the emptied cassette shell 70a by rotating the rotary shaft 122. When further wind-up causes detection of the film trailer on the film end sensor 117, the film trailer is cut in the shape the same as the film leader 73a illustrated in Fig. 6, and then wound up in the cassette shell 70a. The cassette shell 70a after winding up the developed film 73 is ejected from the film wind-up stage 111 by the cassette ejecting mechanism 125 while retracting the supporting plates 119a. Another emptied cassette shell 70a is positioned in the film wind-up stage 111 in a similar manner. The same process of development is repeated. A developed film is wound up and contained in the cassette shell 70a. Because the film trailer is treated as described above and contained in the cassette shell 70a as a newly free end of the developed film on the outermost turn of the roll, this free end can be easily advanced to the outside of the film cassette at the following process of printing.

It is noted that, although an originally used film cassette is conveyed to the film wind-up stage and is used for containing the developed film, a great number of emptied cassette shells 70a may be prepared or beforehand collected and stored in a cassette holder 130 so as to be fed one by one on a film wind-up stage, for which a cassette feeding mechanism 131 of a construction the same as the mechanism 83 is provided in the cassette holder 130. Stopper pins 135 are formed on a solenoids 133, and are retracted from the cassette holder 130 by actuating the solenoids 133 so as to let out a cassette shell 132 containing the developed film toward a receiving tray 136. Elements similar to those in the above embodiment is designated with identical reference numerals in Fig. 11.

Although the film trailer is cut into the shape the same as the film leader before development by the rotary cutter 118, a developed film 138 may be cut in an oblique fashion as illustrated in Fig. 12. It is preferable for this construction to form additional perforations 140 on the same rear end portion up to the vicinity of a last image frame 139 in order to

reliably advance a new free end of the developed film 138 from the cassette shell to its outside. It is thereby possible for drawing the exposed film out of the cassette shell to use a single-toothed sprocket provided in the printer for rotating in the initial step of drawing-out, which makes it more reliable to initially advance the film leader in operative combination with the unwinding rotation of the spool for letting out the film leader. It is also noted that a plush may be preferably attached removably to the cassette shell, because it is unnecessary to contain the developed film in light-tight fashion unlike unexposed film or exposed film before development. It is preferable to remove the plush from the cassette shell by pulling it therefrom after drawing out the exposed film, so that load against advancing a new free end of th developed film from inside the cassette shell can be reduced.

Although the embodiment illustrated in Figs. 6 to 12 is applied to a film cassette in which rotation of the spool can cause a film end to advance to the outside, it may be applied to a conventional film cassette. Although the exposed film is individually drawn out of the film cassette 70 and guided to the processor section 101, a guiding leader sheet may be used for being attached to the film leader advanced outside in order to guide the exposed film to respective processing tanks. The leader sheet is preferably separated before attaching the developed film to the connecting sheet.

Although applied to a film processor, the present embodiment may be applied to a photofinishing machine with a printer connected to a film processor. Instead of using a film portion attached to the spool as connecting sheet, a sheet specialized for connection may be attached to the spool 73 and the film trailer of the photographic film 73. Although the developed film 73 is attached to the connecting sheet 120 of the cassette shell 70a by use of the hot-melt adhesive area 79, the developed film may be attached thereto with splice tape or the like.

Although the present invention has been fully described by way of the preferred embodiments thereof with reference to the accompanying drawings, various changes and modifications will be apparent to those having skill in this field. Therefore, unless otherwise these changes and modifications depart from the scope of the present invention, they should be construed as included therein.

Claims

1. A method for handling a photographic film cassette including a cassette shell, a spool contained in said cassette shell and an exposed photographic film wound about said spool with a film trailer attached thereto, of which spool rotation in a direction of unwinding said exposed film causes a film leader to advance to an outside of said cassette shell, said handling method comprising the steps of:

rotating said spool in said unwinding direction in order to advance said film leader out of said cassette shell; and

drawing said exposed film out of said cassette shell after advancing said film leader for developing said exposed film in a state with said film trailer attached to said spool so as to keep said cassette shell reusable.

2. A photographic film cassette handling method as defined in claim 1, wherein said spool is rotated by a spool rotating device incorporated in a film processor.

3. A photographic film cassette handling method as defined in claim 2, wherein said leader drawing-out step is carried out by clamping said film leader with a catcher provided with said film processor and by displacing said catcher relatively from said cassette shell in a direction of increasing a distance between said catcher and said cassette shell.

4. A photographic film cassette handling method as defined in claim 3, wherein said film cassette further includes:

an annular ridge formed along a circumferential surface of an inside of said cassette shell for contact with an outermost turn of said wound exposed film in order to prevent said exposed film from loosening; and

a separating claw formed inside said cassette shell in a position connected to a film passageway for feeding said exposed film to an outside of said cassette shell in order to separate said film leader from said outermost turn of said wound film.

5. A photographic film cassette handling method as defined in claim 1, further comprising the steps of:

winding up said exposed film into said cassette shell after development;

rotating said spool in said unwinding direction in a printer in order to advance said film leader out of said cassette shell;

drawing said developed film out of said cassette shell frame by frame after advancing said film leader for subjecting said developed film to printing in a state with said film trailer attached to said spool; and

rotating said spool in a direction of winding up said developed film after printing for containing said developed film in said cassette

shell.

6. A photographic film cassette handling method as defined in claim 5, wherein said spool is rotated by a spool rotating device incorporated in said printer.

7. A photographic film cassette handling method as defined in claim 6, wherein said frame-by-frame film drawing-out step is carried out by rotating a sprocket provided in said printer.

8. A photographic film cassette handling method as defined in claim 7, wherein said film cassette is provided with a data recording portion for storing data.

9. A photographic film cassette handling method as defined in claim 8, wherein said printer is provided with recording/reading means for recording at least printing data on to said data recording portion regarding printing image frames created on said exposed film when printing said image frames, and for reading said printing data from said data recording portion when reprinting said image frames.

10. A photographic film cassette handling method as defined in claim 1, further comprising the steps of:

rotating said spool in a direction of winding up said exposed film after development for containing said exposed film in said cassette shell;

rotating said spool in said unwinding direction in a slide-mounting machine in order to advance said film leader out of said cassette shell; and

drawing said developed film out of said cassette shell frame by frame for cutting said developed film into respective film pieces of image frames created on said developed film so as to mount said film pieces on slide mounts.

11. A photographic film cassette handling method as defined in claim 10, wherein said spool is rotated by a spool rotating device incorporated in said slide-mounting machine.

12. A photographic film cassette handling method as defined in claim 11, wherein said frame-by-frame film drawing-out step is carried out by rotating a sprocket provided in said slide-mounting machine.

13. A photographic film cassette handling method as defined in claim 11, wherein said exposed film is reversal film.

14. A method for handling a photographic film cassette including a cassette shell, a spool contained in said cassette shell and a developed photographic film wound about said spool with a film trailer attached thereto, of which spool rotation in a direction of unwinding said developed film causes a film leader to advance to an outside of said cassette shell, said handling method comprising the steps of:

rotating said spool in said unwinding direction in a printer in order to advance said film leader out of said cassette shell;

drawing said developed film out of said cassette shell frame by frame after advancing said film leader for subjecting said developed film to printing in a state with said film trailer attached to said spool; and

rotating said spool in a direction of winding up said developed film after printing for winding said developed film in a roll in order to use said cassette shell for containing said developed film.

15. A photographic film cassette handling method as defined in claim 14, wherein said spool is rotated by a spool rotating device incorporated in said printer.

16. A photographic film cassette handling method as defined in claim 15, wherein said frame-by-frame film drawing-out step is carried out by rotating a sprocket provided in said printer.

17. A photographic film cassette handling method as defined in claim 16, wherein said film cassette further includes:

an annular ridge formed along a circumferential surface of an inside of said cassette shell for contact with an outermost turn of said wound exposed film in order to prevent said exposed film from loosening; and

a separating claw formed inside said cassette shell in a position connected to a film passageway for feeding said exposed film to an outside of said cassette shell in order to separate said film leader from said outermost turn of said wound film.

18. A photographic film cassette handling method as defined in claim 15, wherein said film cassette is provided with a data recording portion for storing data.

19. A photographic film cassette handling method as defined in claim 18, wherein said printer is provided with recording/reading means for re-

cording at least printing data on to said data recording portion regarding printing image frames created on said exposed film when printing said image frames, and for reading said printing data from said data recording portion when reprinting said image frames.

20. A photographic film cassette handling method as defined in claim 19, wherein said developed film is handled in development in the steps of:

rotating said spool in said unwinding direction for advancing said film leader of said photographic film out of said cassette shell after exposure;

drawing out said photographic film until drawing a first end of a connecting sheet out of said cassette shell, said connecting sheet beforehand being wound on said spool together with said photographic film in a state with said first end connected to said film trailer and with an opposite second end fixed on said spool in order to connect said photographic film to said spool;

separating said photographic film from said connecting sheet for development;

connecting said photographic film after development to said first end of said connecting sheet drawn out of said cassette shell; and

rotating said spool in said winding-up direction for containing said developed film in said cassette shell together with said connecting sheet.

21. A photographic film cassette handling method as defined in claim 20, wherein said spool is rotated by a spool rotating device incorporated in a film processor.

22. A photographic film cassette handling method as defined in claim 21, wherein said film drawing-out step is carried out by nipping said photographic film with a pair of drawing rollers incorporated in said film processor and rotating said drawing rollers.

23. A photographic film cassette handling method as defined in claim 21, wherein said first end of said connecting sheet is spliced to said film leader after development.

24. A photographic film cassette handling method as defined in claim 23, wherein said cassette shell separated from said photographic film is conveyed during development to a position where said film leader is to be positioned for a splice after development.

25. A photographic film cassette handling method as defined in claim 23, further comprising the steps of:

repeating said separating step for a plurality of photographic films;

conveying a plurality of cassette shells separated from said plurality of photographic films during development to a position where film leaders of said plurality of photographic films are to be positioned for a splice after development; and

providing one of said plurality of cassette shells to said developed film for performing said connecting step.

26. A photographic film cassette handling method as defined in claim 23, wherein said film trailer is beforehand attached directly to said spool, said photographic film drawn out is cut outside said cassette shell, and a trailer remainder of said film trailer thereby remaining on said cassette shell is used for said connecting sheet.

27. A photographic film cassette handling method as defined in claim 26, wherein said trailer remainder is provided with a hot-melt adhesive area formed in a vicinity of said first end, and said film leader is thereby spliced to said trailer remainder.

28. A photographic film cassette handling method as defined in claim 27, wherein said film trailer is cut so as to reduce a width between two lateral sides before winding up said film trailer in said cassette shell when containing said developed film in said cassette shell in order to facilitate an advance of said film trailer toward an outside of said cassette shell in a state where said developed film is wound up in said cassette shell with said film trailer wound outside thereabout.

29. A photographic film cassette handling method as defined in claim 27, wherein said film trailer is cut so as to form an oblique end before winding up said film trailer in said cassette shell when containing said developed film in said cassette shell in order to facilitate an advance of said film trailer toward an outside of said cassette shell in a state where said developed film is wound up in said cassette shell with said film trailer wound outside thereabout, and provided with perforations perforated along one lateral side for said advance toward an outside.

30. A method for handling a photographic film cassette including a cassette shell, a spool contained in said cassette shell and an ex-

posed photographic film wound about said spool with a film trailer attached thereto, of which spool rotation in a direction of unwinding said exposed film causes a film leader to advance to an outside of said cassette shell, said handling method comprising the steps of:

rotating said spool in said unwinding direction in order to advance said film leader out of said cassette shell;

drawing said exposed film out of said cassette shell after advancing said film leader for developing said exposed film in a state with said film trailer attached to said spool;

winding up said exposed film into said cassette shell after development;

rotating said spool in said unwinding direction in a printer in order to advance said film leader out of said cassette shell;

drawing said exposed film out of said cassette shell frame by frame after advancing said film leader for subjecting said exposed film to printing in a state with said film trailer attached to said spool; and

rotating said spool in a direction of winding up said exposed film after printing for winding said exposed film in a roll in order to use said cassette shell for containing said exposed film after development.

31. A method for handling a photographic film cassette including a cassette shell, a spool contained in said cassette shell and an exposed photographic film wound about said spool with a film trailer attached thereto, of which spool rotation in a direction of unwinding said exposed film causes a film leader to advance to an outside of said cassette shell, said handling method comprising the steps of:

rotating said spool in said unwinding direction in order to advance said film leader out of said cassette shell;

drawing said exposed film out of said cassette shell after advancing said film leader for developing said exposed film in a state with said film trailer attached to said spool;

rotating said spool in a direction of winding up said exposed film after printing for winding said exposed film in a roll in order to use said cassette shell for containing said exposed film after development.

rotating said spool in said unwinding direction in a slide-mounting machine in order to advance said film leader out of said cassette shell; and

drawing said exposed film out of said cassette shell frame by frame for cutting said exposed film into respective film pieces of image frames created on said exposed film so as to mount said film pieces on slide mounts.

32. A method for handling a photographic film cassette including a cassette shell, a spool rotatably contained in said cassette shell, an exposed photographic film wound about said spool, and a connecting sheet beforehand being wound on said spool together with said exposed film in a state with a first end connected to a film trailer of said exposed film and with an opposite second end fixed on said spool in order to connect said exposed film to said spool, said handling method comprising the steps of:

drawing out said exposed film until drawing said first end of said connecting sheet out of said cassette shell;

separating said exposed film from said connecting sheet for development;

connecting said exposed film after development to said first end of said connecting sheet drawn out of said cassette shell; and

rotating said spool in a direction of winding up said exposed film for winding said exposed film with said connecting sheet in a roll in order to use said cassette shell for containing said exposed film after development.

33. A photographic film cassette handling method as defined in claim 32, wherein said film trailer is beforehand attached directly to said spool, said exposed film drawn out is cut outside said cassette shell, and a trailer remainder of said film trailer thereby remaining on said cassette shell is used for said connecting sheet.

FIG. 1

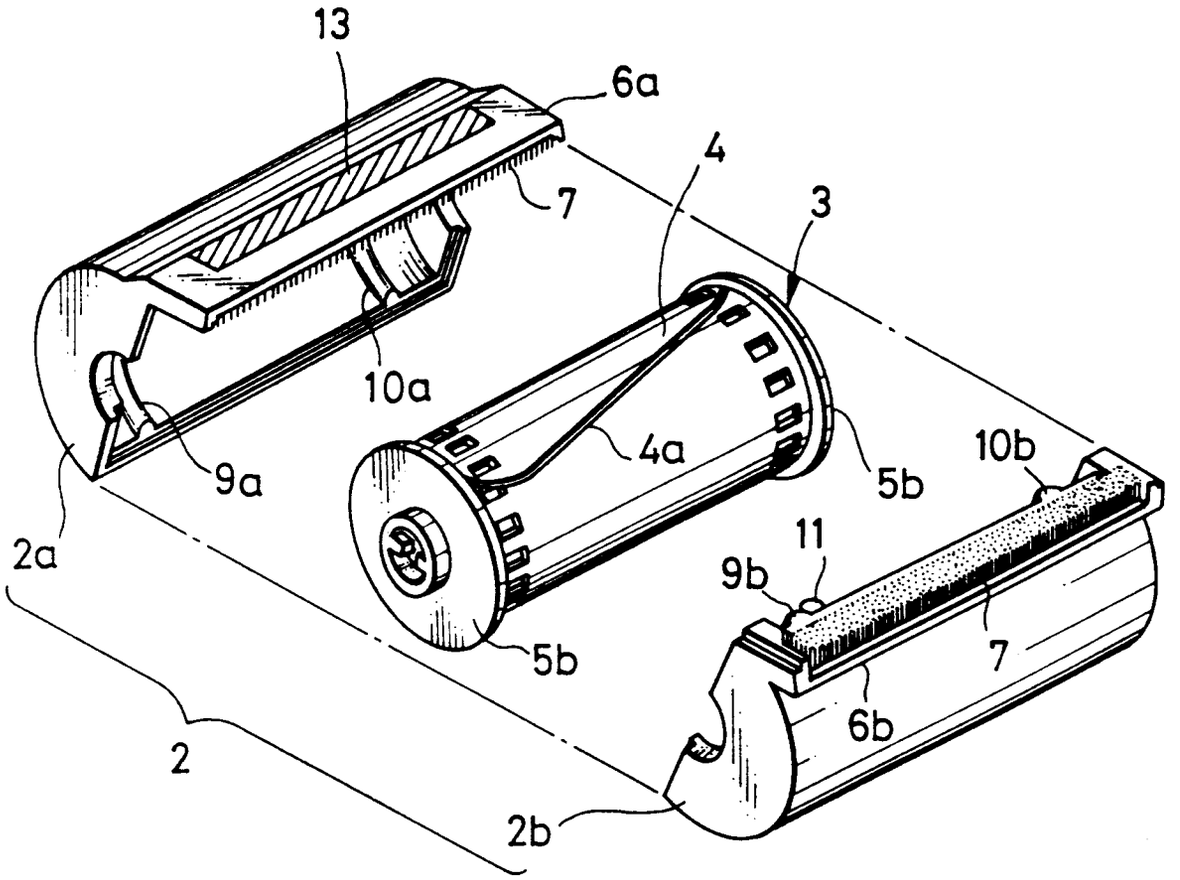

FIG. 2

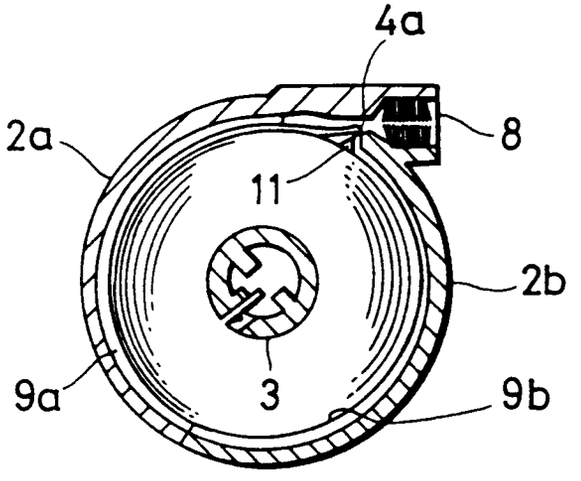

FIG. 3

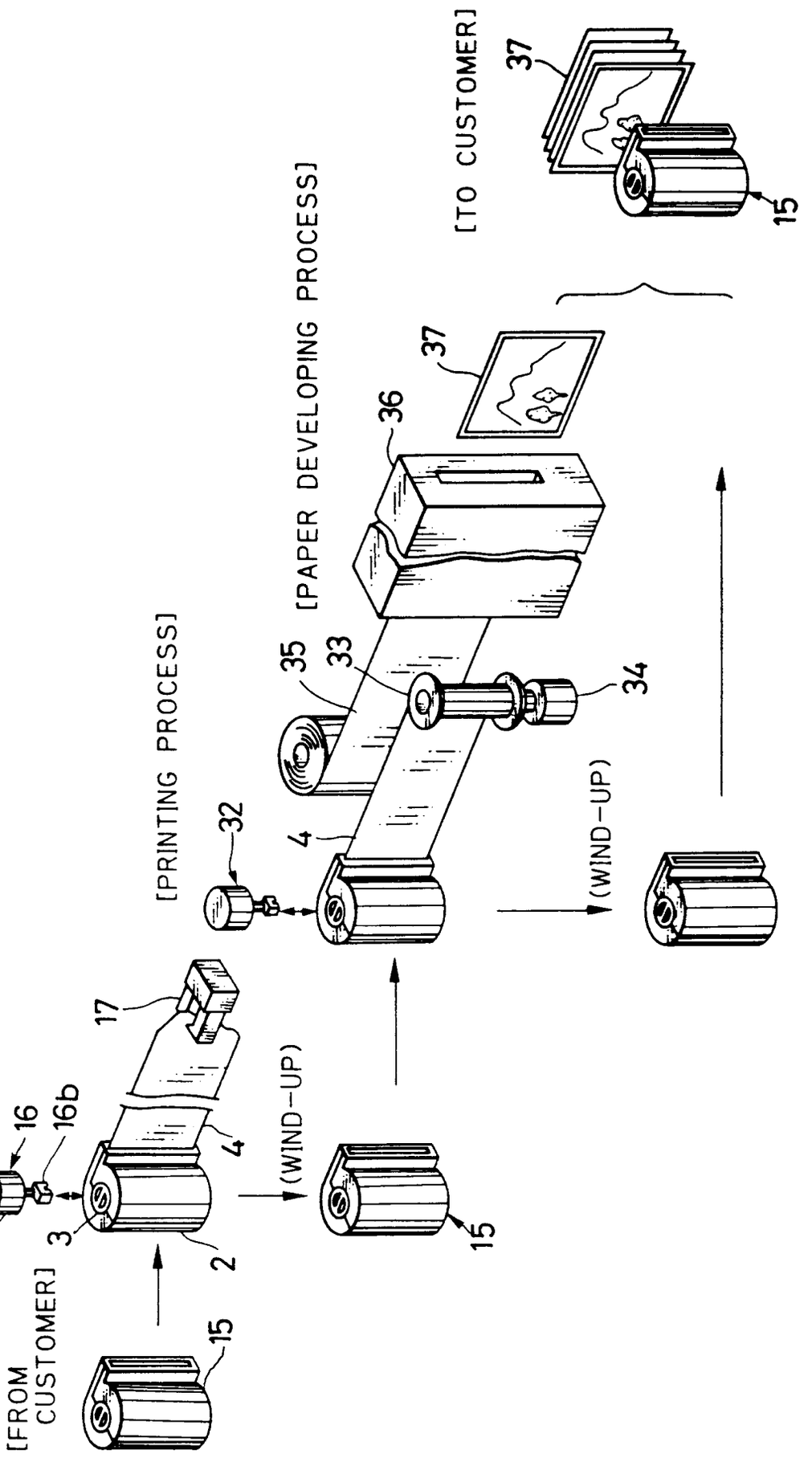
[FILM DEVELOPING PROCESS]
[PRINTING PROCESS]
[PAPER DEVELOPING PROCESS]
[TO CUSTOMER]
[FROM CUSTOMER]
(WIND-UP)
(WIND-UP)
15
15
15
16
16a
16b
17
2
3
4
4
32
33
34
35
36
37
37

FIG. 4

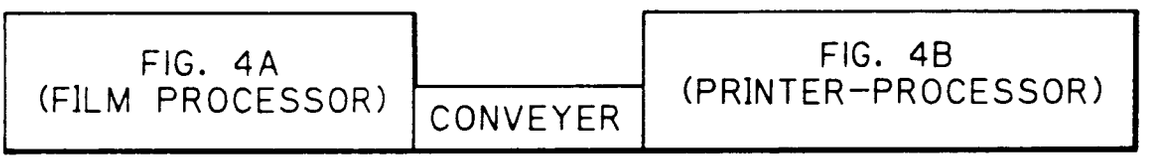

FIG.4A

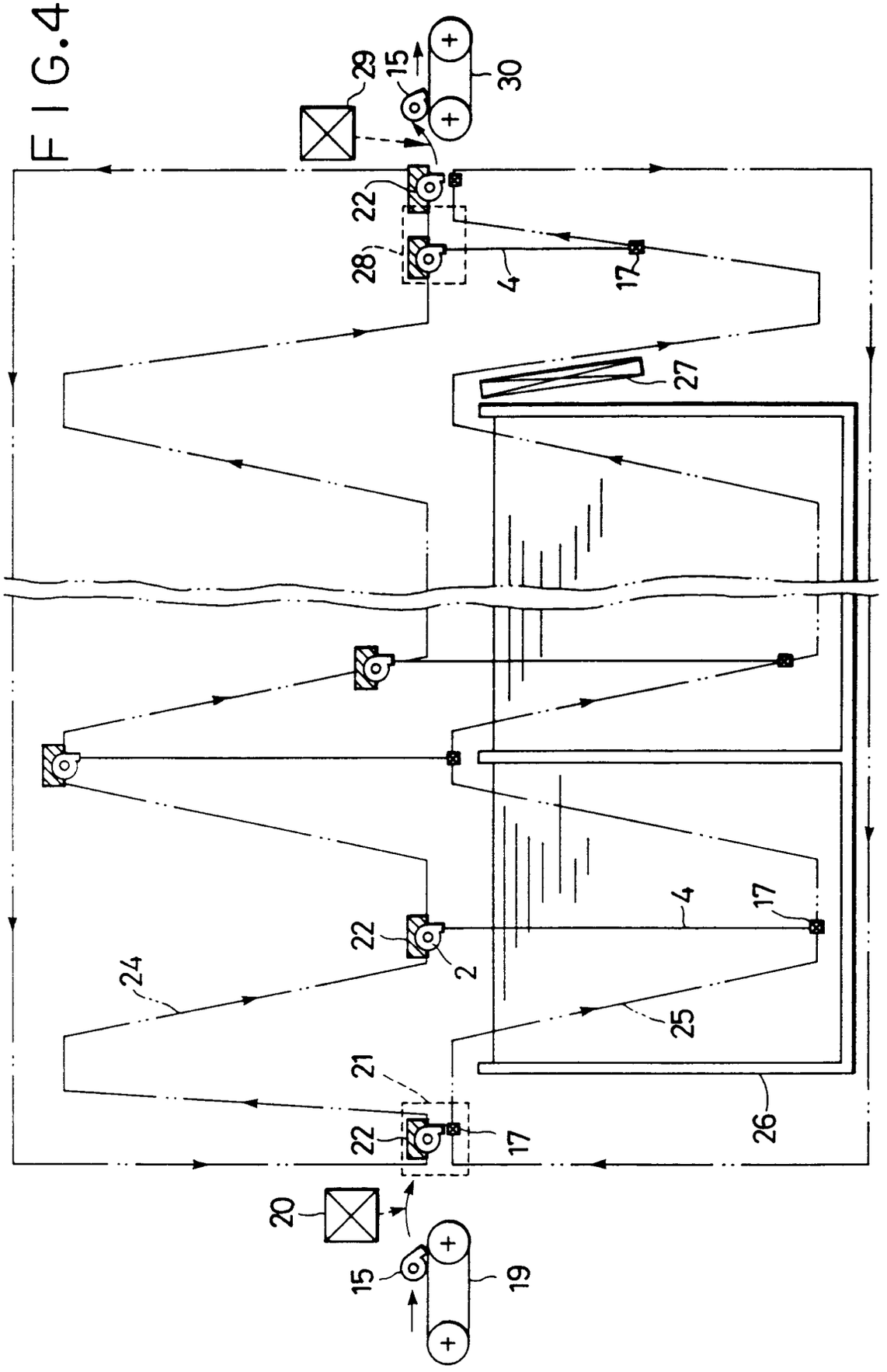

FIG. 4B

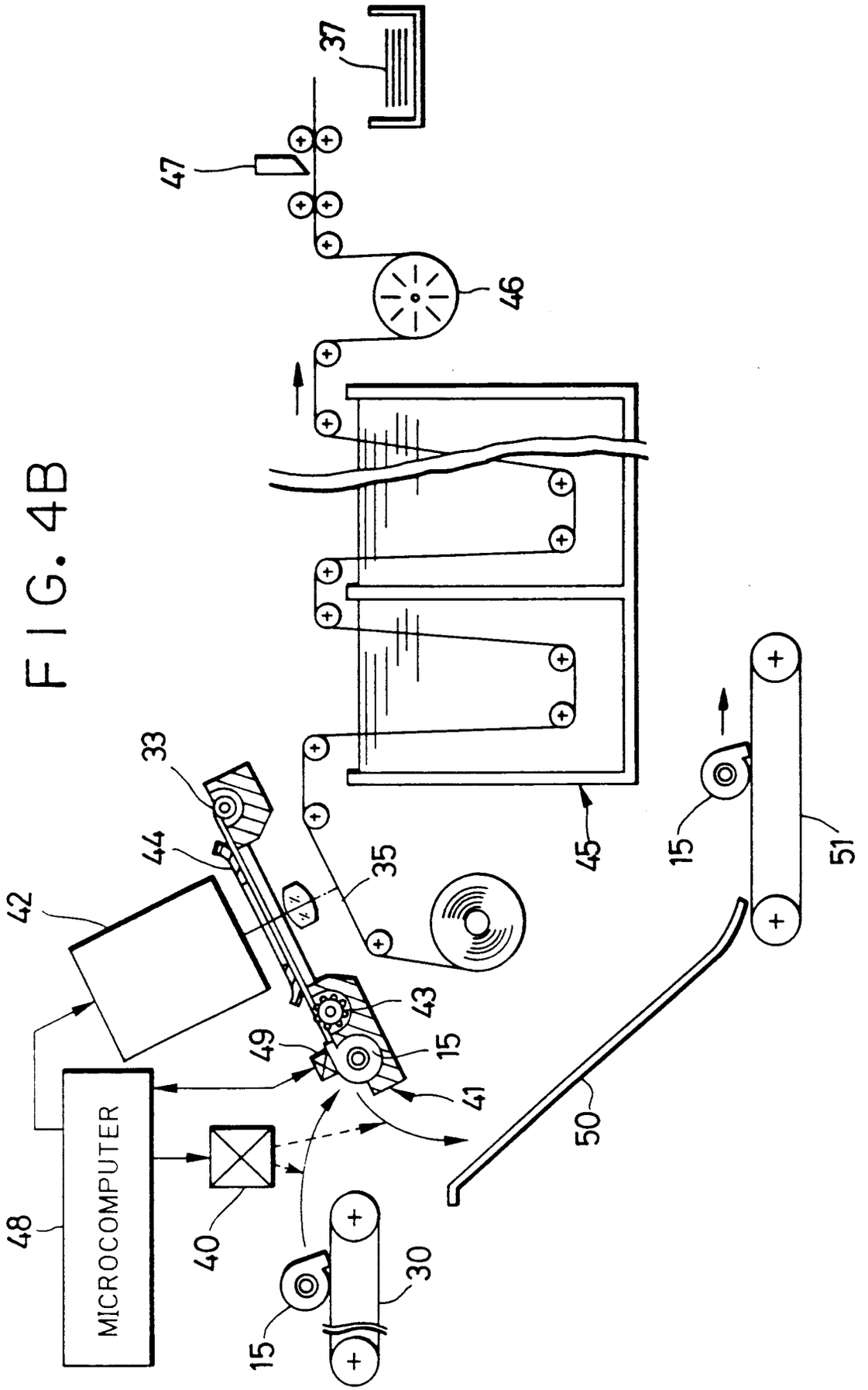
37
47
46
45
33
44
35
42
43
49
15
41
MICROCOMPUTER
48
40
30
15
50
15
51

FIG. 5

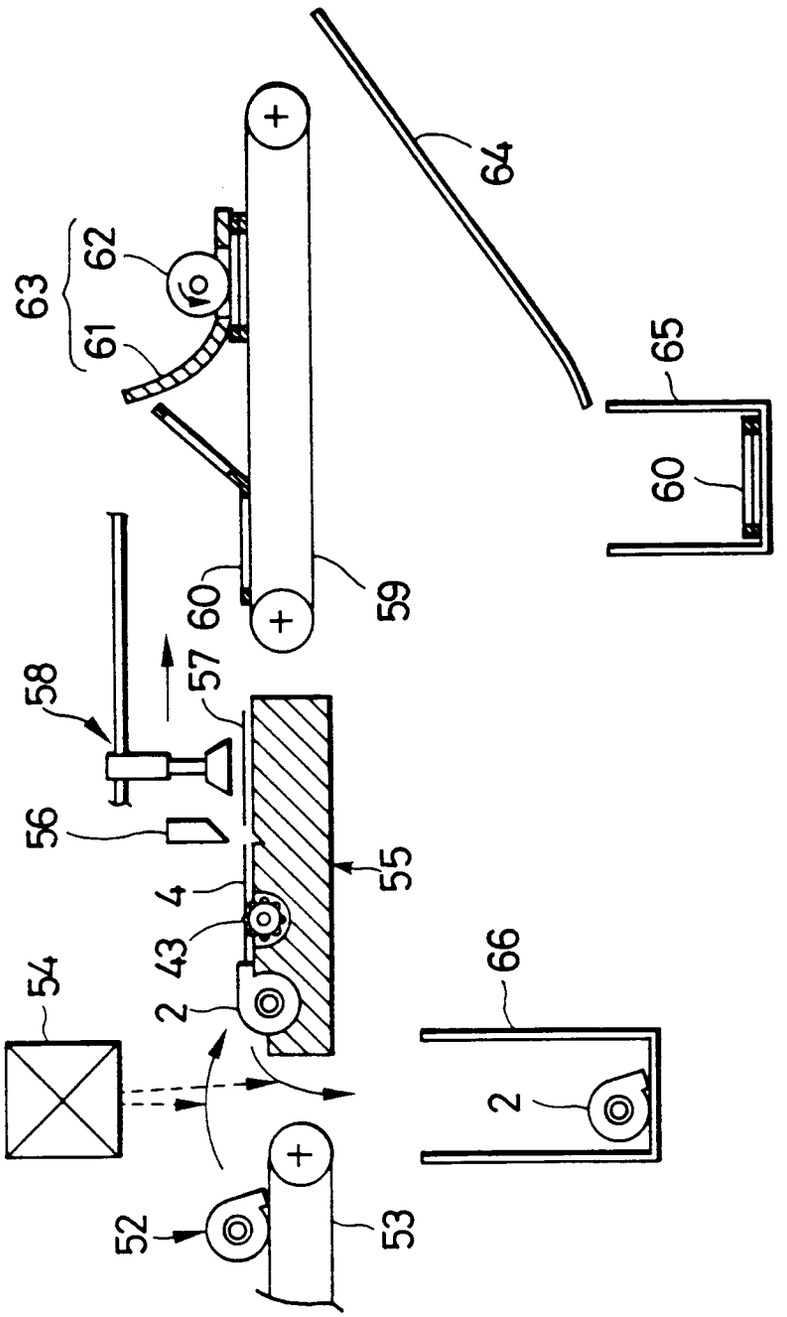

FIG. 6

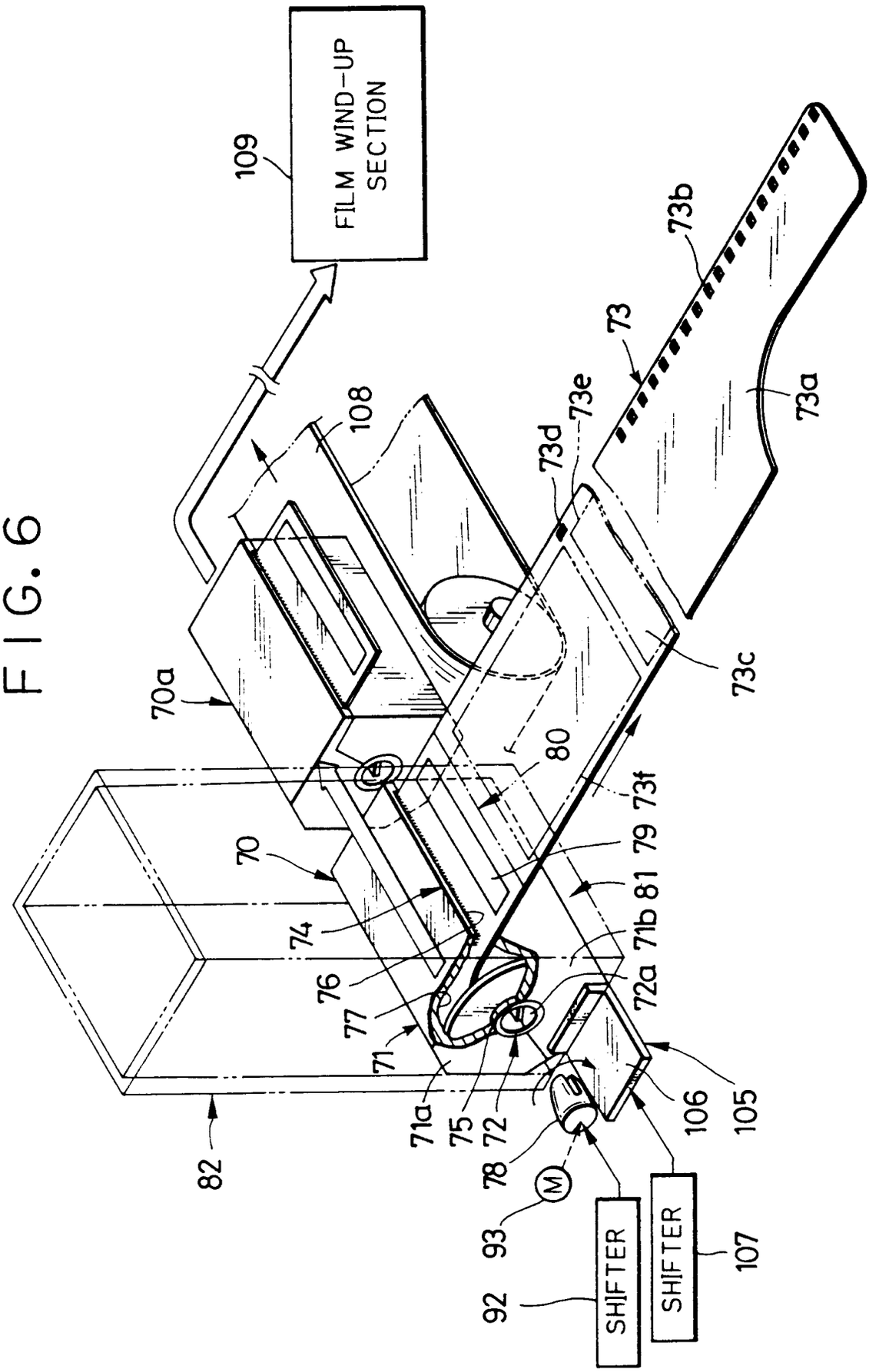
FILM WIND-UP SECTION
109
108
73b
73
73a
73e
73d
73c
70a
80
73f
70
79
81
71b
74
72a
76
77
71
71a
75
72
78
106
105
82
M
93
92
SHIFTER
SHIFTER
107

FIG. 7

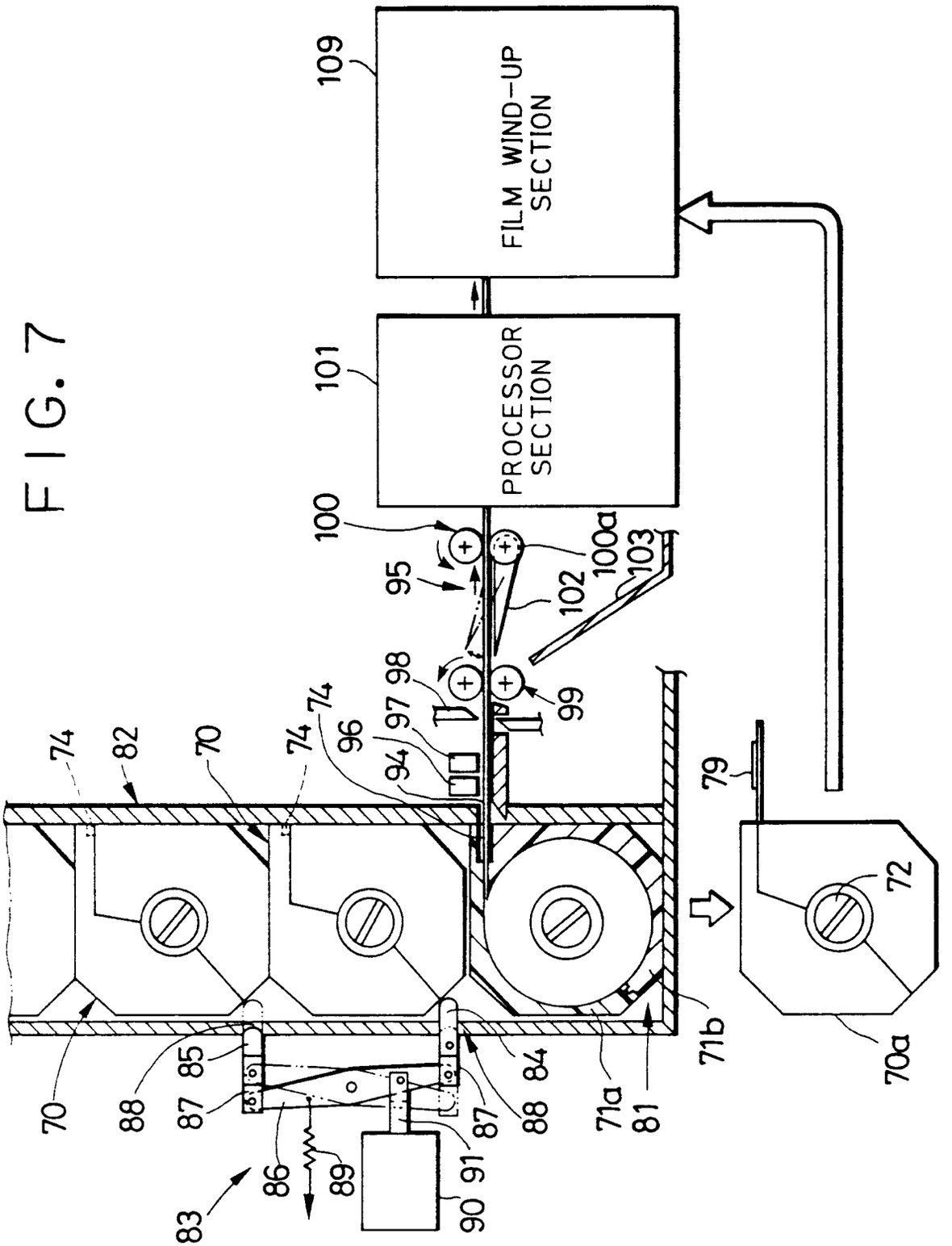
109
FILM WIND-UP SECTION
101
PROCESSOR SECTION
100
100a
103
102
95
98
97
99
96
94
74
82
70
79
72
71b
70a
71a
81
84
88
85
87
86
89
90
91
83

FIG. 8

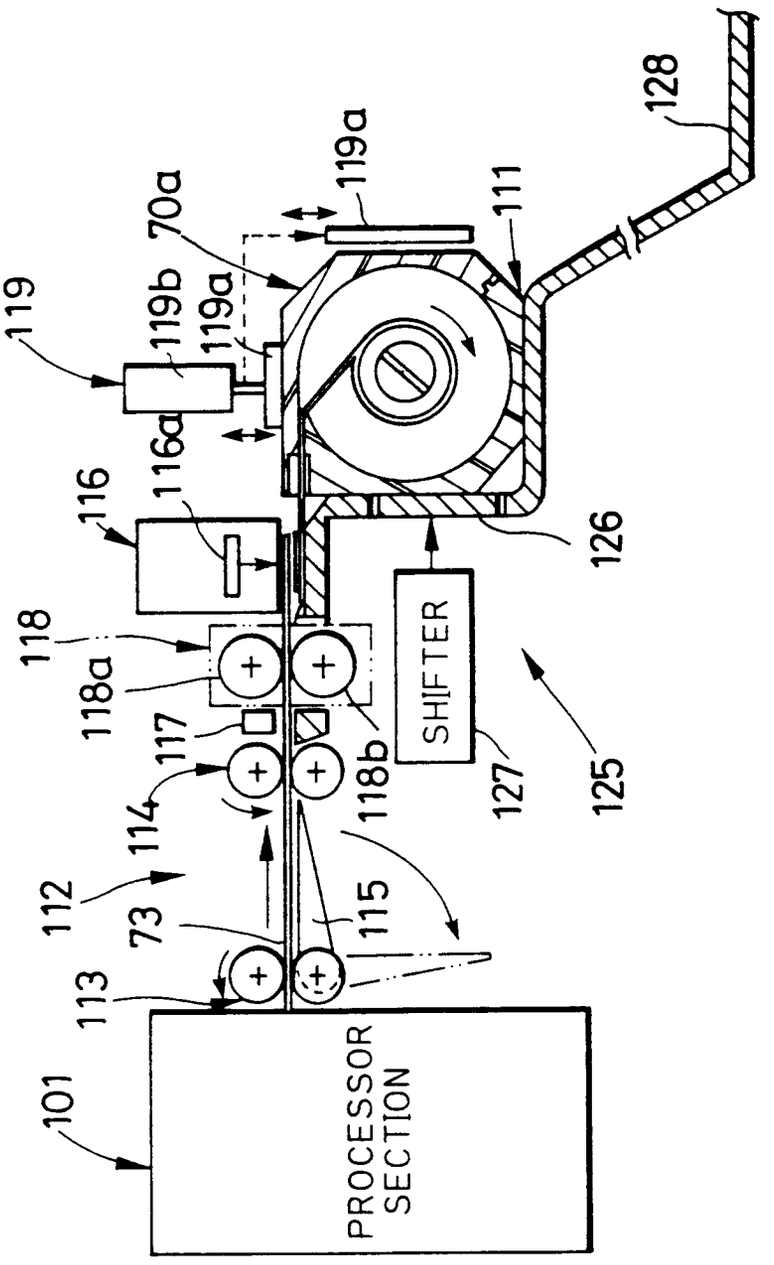
PROCESSOR SECTION
SHIFTER
101
113
112
73
114
115
117
118
118a
118b
116
116a
119
119b
119a
70a
111
128
126
127
125

FIG. 9

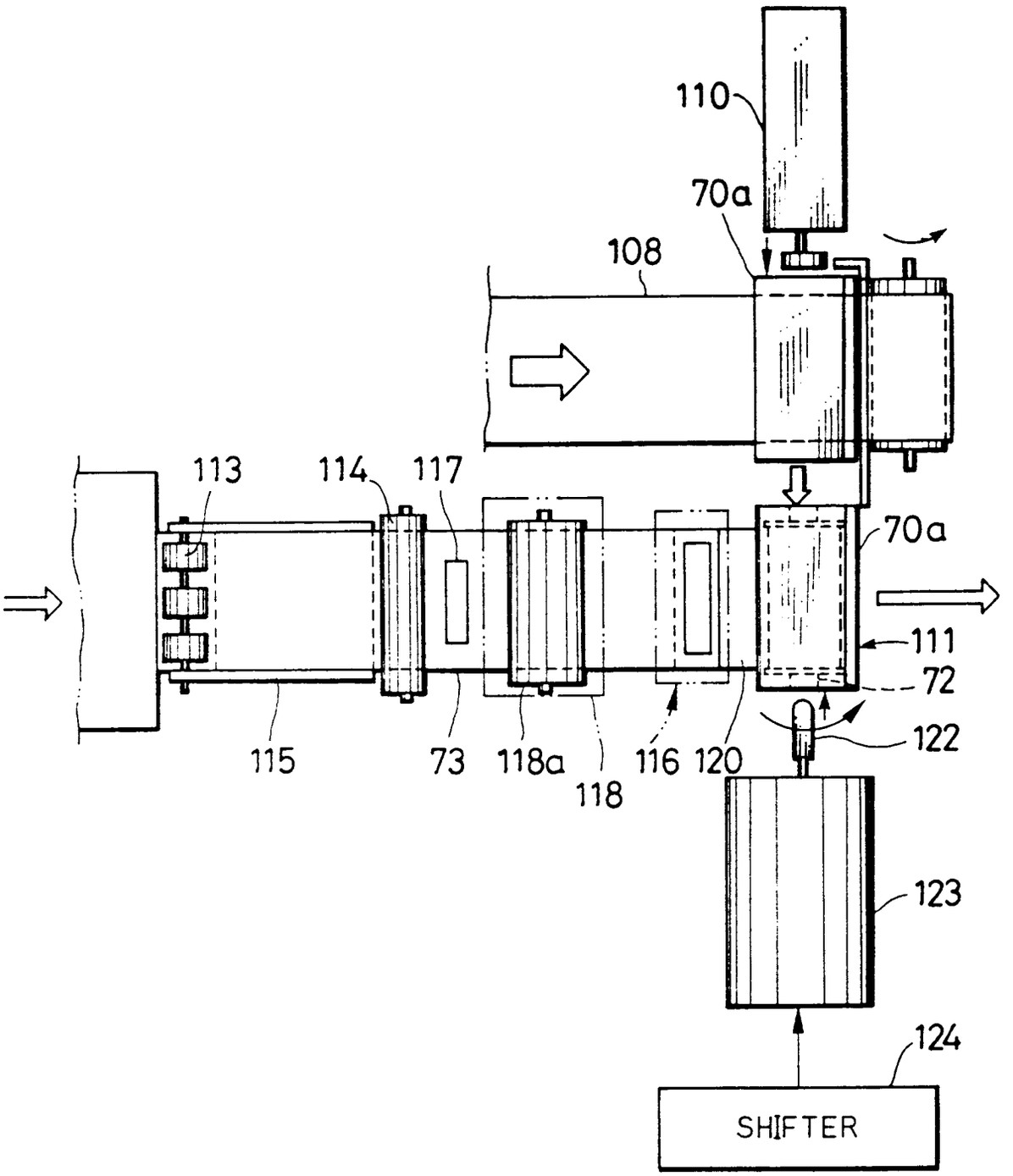
110
70a
108
113
114
117
70a
111
72
122
115
73
118a
118
116
120
123
124
SHIFTER

FIG.10

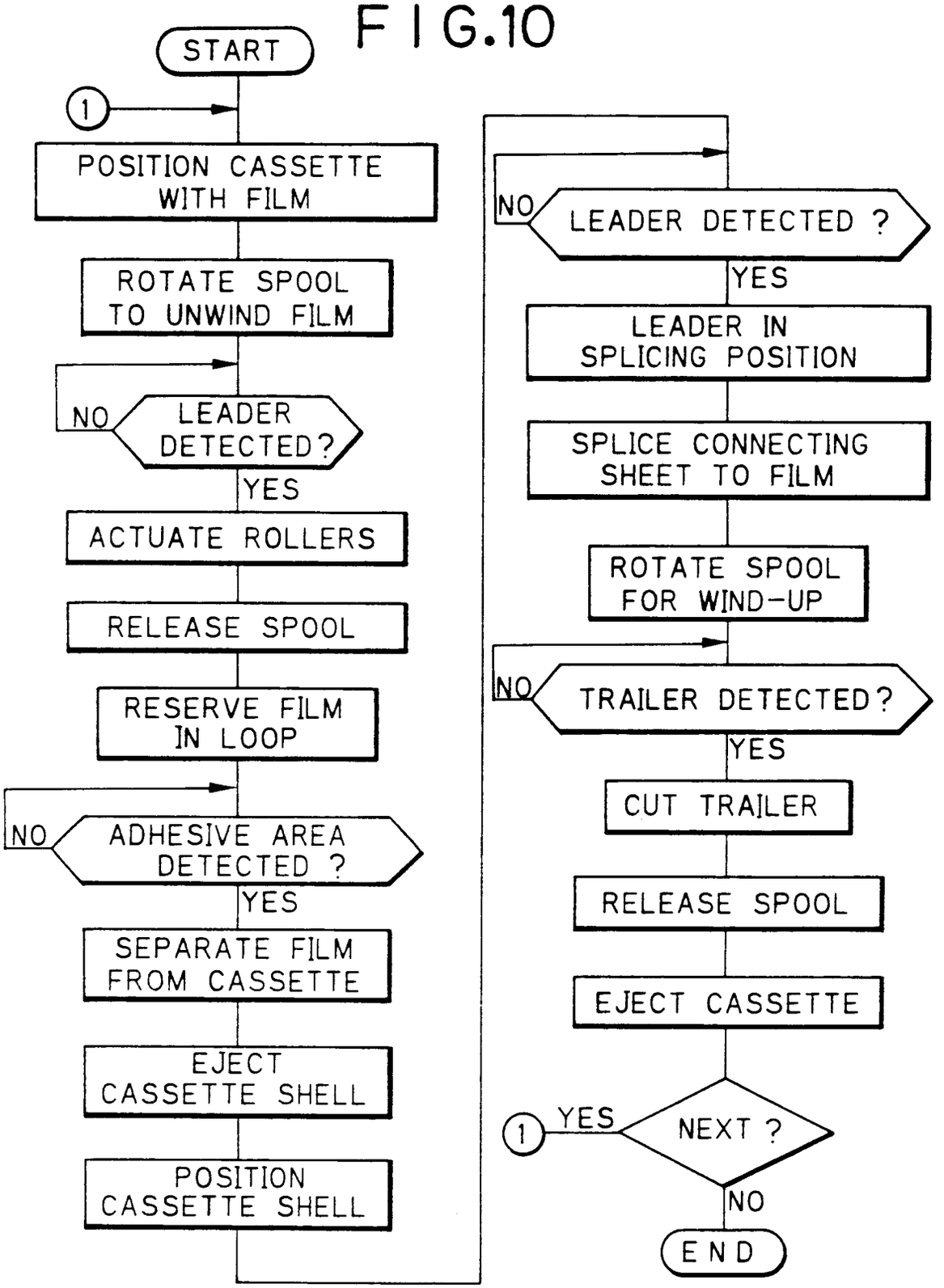
START
1
POSITION CASSETTE WITH FILM
ROTATE SPOOL TO UNWIND FILM
NO
LEADER DETECTED?
YES
ACTUATE ROLLERS
RELEASE SPOOL
RESERVE FILM IN LOOP
NO
ADHESIVE AREA DETECTED ?
YES
SEPARATE FILM FROM CASSETTE
EJECT CASSETTE SHELL
POSITION CASSETTE SHELL
NO
LEADER DETECTED ?
YES
LEADER IN SPLICING POSITION
SPLICE CONNECTING SHEET TO FILM
ROTATE SPOOL FOR WIND-UP
NO
TRAILER DETECTED?
YES
CUT TRAILER
RELEASE SPOOL
EJECT CASSETTE
1
YES
NEXT ?
NO
END

FIG. 11

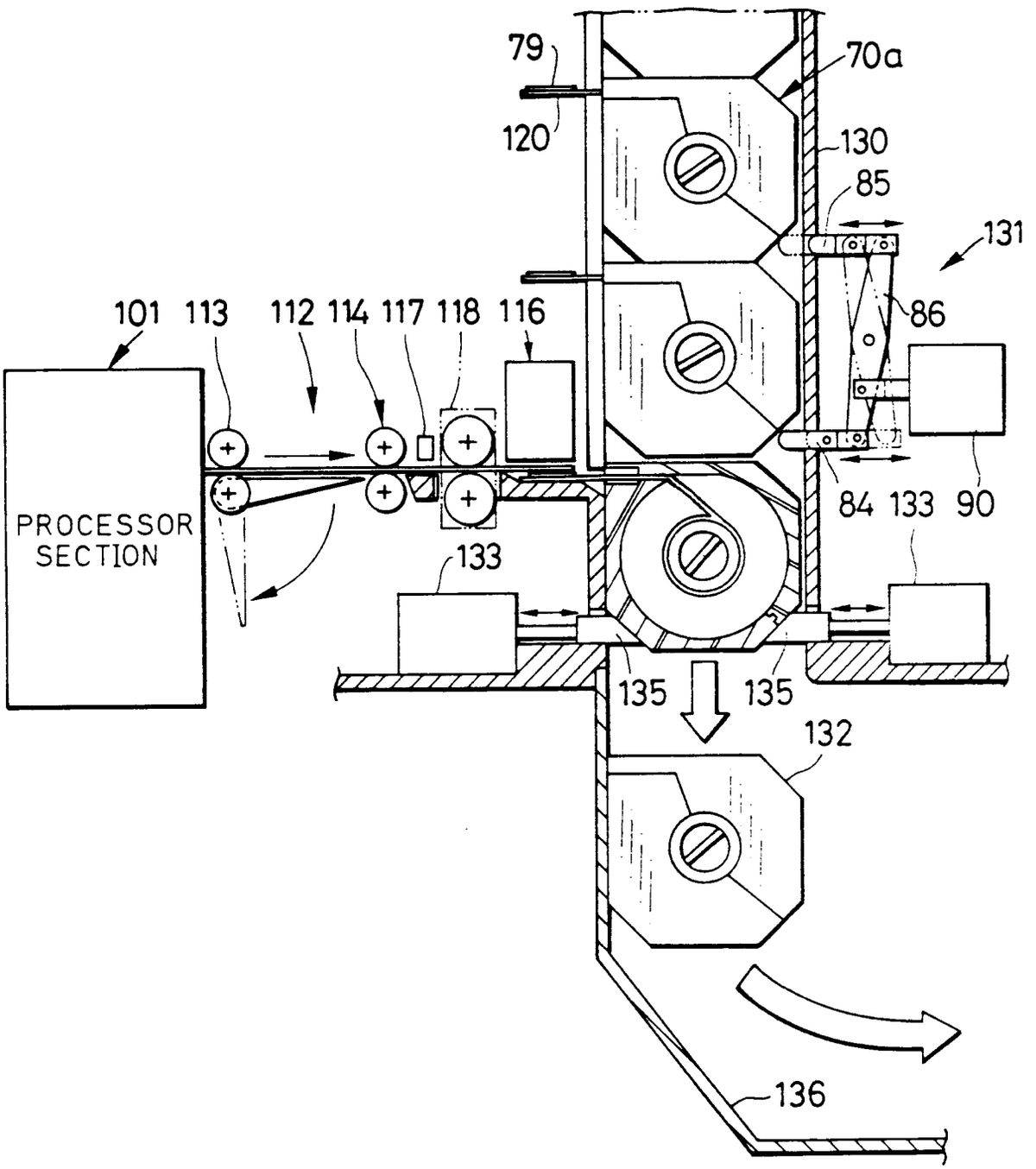
79
120
70a
130
85
131
86
101
113
112
114
117
118
116
PROCESSOR SECTION
84
133
90
133
135
135
132
136

FIG. 12